

APPENDIX A-2

REPORT ON SOIL ENRICHMENT FOR SOIL EROSION CONTROL

By: Forestry Department

**SARAKATA HYDROPOWER ENVIRONMENTAL MONITORING AND
REHABILITATION**

**JULY 2005
(REXON VIRANAMANGGA)**

Introduction;

The environmental monitoring and rehabilitation was done on July 2005 following recommendations made during the vegetation study that was carried out on February 2005 at the Sarakata Hydropower (HP) water catchments area. The activities carried were enrichment planting at landslide areas and construction of soil entrapment where soil erosion occurred.

Enrichment Plantings.



Transporting seedlings to site



Mahogany and Natora planted at the landslide site



Mahogany seedlings



Palm seedlings planted at the base of the man-made cliff



Construction of soil entrapment





Exposed areas still to be planted with Vetiva grass (Vetiva not found around Luganville)



APPENDIX B

REPORT ON SLOPE STABILIZATION FOR LAND SLIDES AND LAND CRACKS CONTROL

By: Public Works Department



REPUBLIC OF VANUATU

SLOPE STABILIZATION WORKS FOR SARAKATA HYDRO

Since the initial construction of the Hydro in 1994, there has been some defects mainly concerning the slope or cut embankment where the water channel is located.

On 9th September 2004 the stage three TAG team had a familiarization visit to the site. PWD was also part of the team and thus had the opportunity to assess the current structure condition.

CURRENT CONDITIONS

REINFORCED CONCRETE CHANNEL

The channel is 2.5 meters wide and 1.6 meters deep and 800 meters long. The structure is constructed along a cut embankment.

The structure itself has no defects and still maintains its original position with the intake of water for the last 10 years.



LANDWARD EMBANKMENT

From the intake dam to the head tank the slope has had natural vegetation overgrown on its surface. This has therefore made the cut slope rigid and by visual inspection the slope has no defects or signs of land slides.



RIVER SIDE EMBANKMENT

This is where defects or landslides is visible. The following was observed:

- 1 Longitudinal cracks.
- 2 Landslides occurring on various sections along the cut slope. The length of the deteriorated section is about 400 meters.

There are three possible reasons;

- 1 During construction the slope was not stabilized. The weight of the growing vegetation might have caused the land to slide down hill.

- 2 Run-off from rain causes surface erosion and contributes to the land de-stabilization causing it to slide downwards.
- 3 There might be cracks on the river Channel therefore water escaping from the channel and contributing to the landslides.

The damages indicate that this area has become unstable and may lead to the collapse of the structure. The situation may worsen if water is allowed to seep in the cracks.



SCOPE OF WORKS

The following are considered.

IMMEDIATE ACTION

Clean up the area and fill cracks and depressions with soil. Cover the whole longitudinal area with a damp proof course [black plastic].

This solution is only a temporary to delay the landslide but in the long range the landslide might continue.

LONG TERM ACTION

There are two options;

- 1 Clear the whole river side slope. Construct retaining reinforced wall or gabion basket massive structure which take the form of a wall stepped on the external face along the river edge and top off or filled with top soil. Reno mattresses to face the upper part of the embankment.
- 2 Drive sheet piles along the entire length and 1 meter away from the edge of the canal. Sheet piles should take a maximum depth of between 40 to 50 meters.

COST ESTIMATES

WORK	DIMENSIONS [M]	QUANTITY	UNIT PRICE [VT]	AMOUNT [VT]
immediate action	800 X 5	600	4,000	2,400,000
Long term Option 1	800 x 80	32,000	1,000	32,000,000
Long term Option 2	800 x 1	3,000	7,000	21,000,000

The estimated cost includes all associated works that are necessary for the completion of this stabilization works.

RECCOMENDATIONS

MONITORING

PWD is recommending that the channel be monitored twice every month. This must be done until remedial works is complete. After then monitoring can be done every six months or whenever the need arises.

The sole purpose of this monitoring exercise is to closely monitor the movement of the channel structure so as to indicate if the structure is affected by the land slide by tilting.

The landward embankment should also be observed monthly to indicate the possibility of land slides or defects.

SCOPE OF WORKS

There has been various discussion within PWD on this matter and has recommended that the two long term remedial works as indicated above are both recommended.

Both are seen to be of best work practice in order to stabilize the current slope. However a more detail survey study is recommended

and should be conducted. This will ensure that remedial works concluded should solve the current situation permanently.

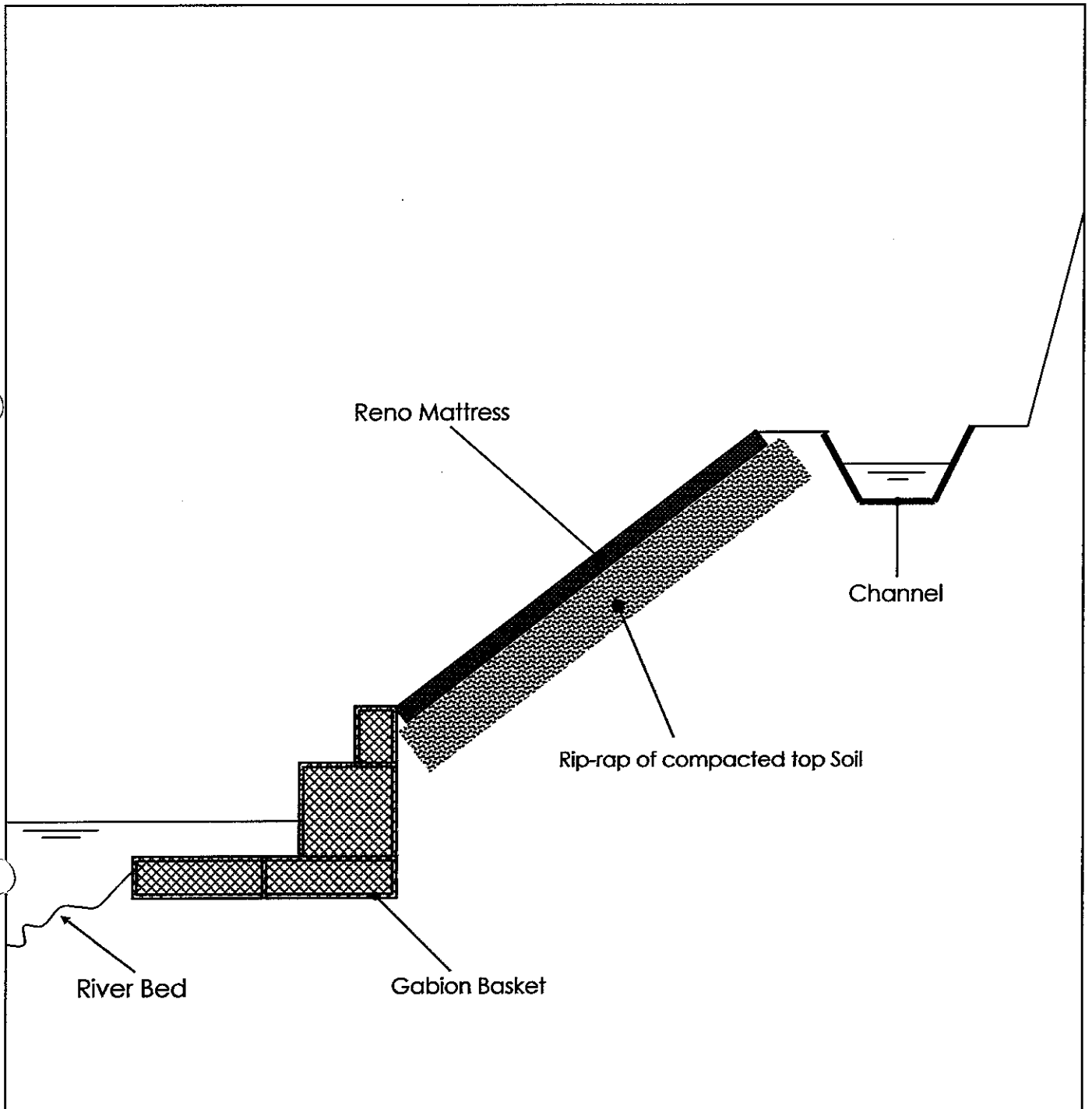
For the time being recommendation of the immediate actions should be carried out. Excavations on land slide areas or where cracks are visible should be done so that the channel wall can be surveyed to indicate crack visibility. Once identified sealing of these cracks must be done to stop outflow of the water.

In any case the works should be done in an environment friendly approach so as to keep the natural beauty of sarakata hydro site in its current state.

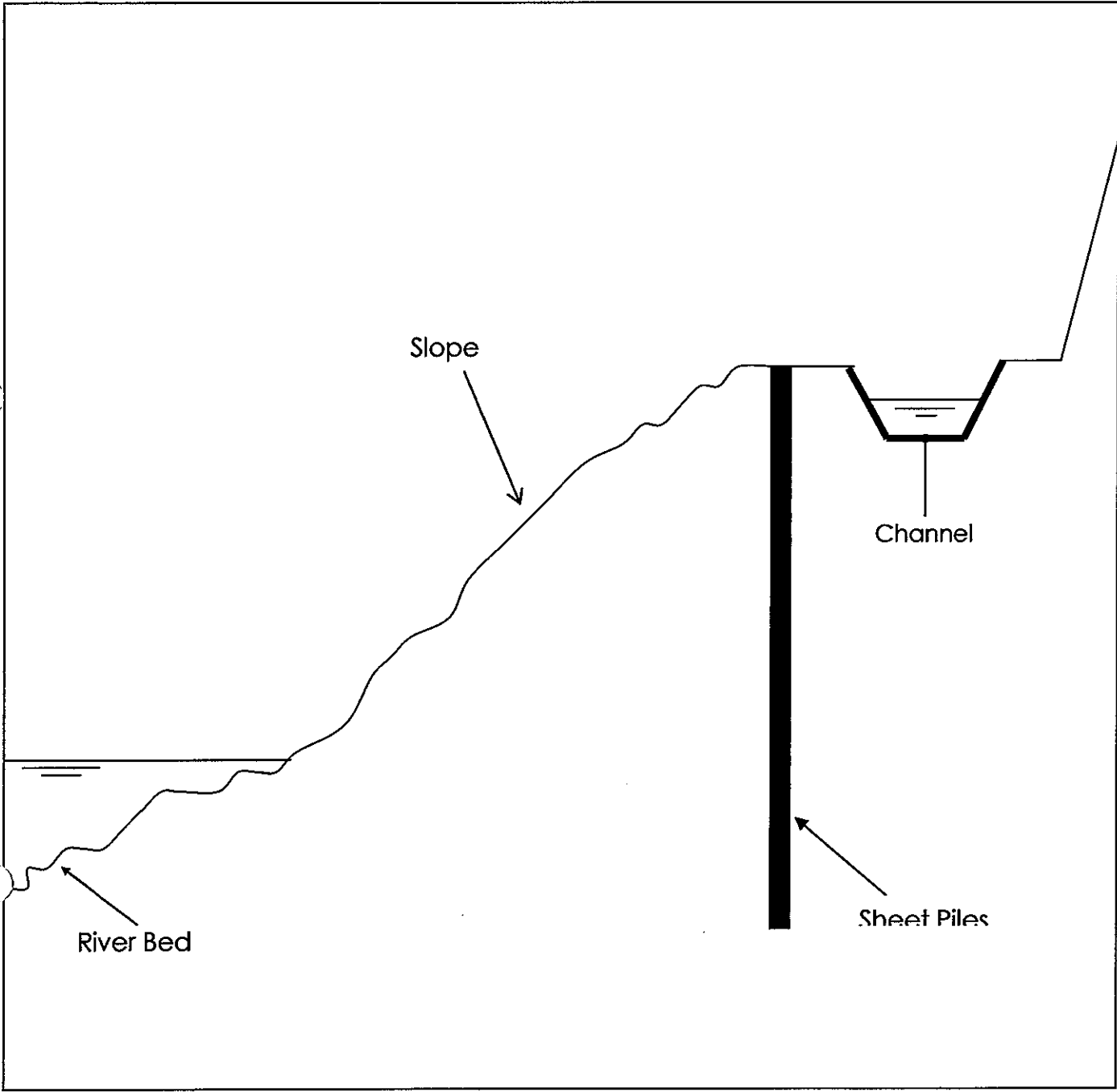


Willie Watson
Public Works Department
September 2004

Appendix 1
LONG TERM OPTION 1 SKETCH



Appendix 2
LONG TERM OPTION 2 SKETCH



Appendix 3
IMMEDIATE ACTION SKETCH

